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ABSTRACT

The successful integration of microcomputer support to help prepare for an anticipated budget crisis at the University of Illinois at Chicago is described. The IBM Personal Computer and VisiCalc software were key tools in the decision support system. When campus executives were instructed to cut budgets and reallocate funds to produce a "Doomsday Planning Budget," a micrcomputer based system was developed to analyze both historical funding and current resource allocation patterns. In addition, the system includes a "what-if" module that permits decision makers to test resource allocation alternatives. Major stages of the construction of the database were identification and extraction of source data, development of a comprehensive master database, and creation of an executive data cube (an application database). The database covers the following dimensions: current budget allocation information, the history of the allocations, details concerning administrative services personnel, and some measure of external factors that influence the allocations and expenditures. Diagrams help to illustrate the construction of the database. Ten suggestions for other colleges are included. (SW)

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EXECUTIVE DECISION MAKING: USING MICROCOMPUTERS IN BUDGET PLANNING

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The IBM Personal Computer and VisiCalc software were key tools in a decision support system designed to assist the Vice Chancellor for Administration prepare for an anticipated budget crisis at the University of Illinois at Chicago. When campus executives were instructed to cut budgets and reallocate funds to produce a "Doomsday Planning Budget", the Office of Campus Planning developed a microcomputer based system to analyze both historical funding and current resource allocation patterns. In addition, the system includes a "what-if" module which permits decision makers to test resource allocation alternatives. A summary report identifies the effects of substantial budget cuts on services to students and faculty.

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INTRODUCTION

A budget is more than a statement about money, it is the end product of a critical executive decision making process. In every university, college, department or entity with its own budget, that budget contains a message about the plans and priorities of the unit's chief executive. The budget displays the executive's decisions concerning new initiatives and expansions and contractions of existing programs. It documents his decisions regarding resource allocations. Moreover, the budget puts the executive's decisions on the line making them visible to the persons to whom the executive is accountable.

While ultimate responsibility for budget decisions rests with the chief executive of the budget unit, a host of others influence decisions made throughout the process of drafting budget requests and throughout the process of allocating resources within the budgeting unit. For example, a vice chancellor is influenced by the deans who report to him, by his peers competing for resources, by the Chancellor and, of course, by his own staff who provide information and advice. The amount and type of influence each of these constituents exercises depends upon the problem solving and decision making styles used by the executive.

In the university environment collegial decision making is viewed as the norm, especially in academic departments. However, we are accustomed to seeing a variety of styles. As described by Chaffee[1], budgeting, like all complex decision making exercises, involves a blend of decision making styles. Decision makers use political, collegial, bureaucratic, and rational styles at different stages of the process. The mix of these styles will vary depending upon the importance of the decision, the time available in which to make the decision, the power of the constituents influencing the decision maker and the position and personality of the decision maker.

However, in the last few years, two major external forces -- one economic and one technological -- have profoundly influenced decision making styles in universities, especially in relation to budget and resource allocation. First, fiscal stringency and projected enrollment declines have created a demand for greater accountability and necessitate the acquisition of better information regarding fiscal matters. Second, improved computer technology and better understanding of the executive's informational needs have made available more appropriate and timely information. Both of these forces have resulted in the increased popularity of rational decision making.

Both economic and technological forces were at work last winter at the University of Illinois at Chicago when the sudden disclosure of a shortfall in expected state revenues precipitated a University-wide budget crisis and a call from the President of the University for a "Doomsday Planning Budget."

[1]Ellen Earle Chaffee, Rational Decisionmaking in Higher Education (Boulder: National Center for Higher Education Management Systems, 1983).

In December 1982, Governor Jim Thompson announced that the State of Illinois was facing a budget crisis. Like many of her sister industrial states, Illinois was suffering because of the nation-wide economic recession. There was a shortfall in expected state revenues, principally due to reduced sales tax income and an increase in state expenditures for unemployment insurance and welfare payments. The Governor ordered a roll back in budgets, including a 2% budget cut, a $7.1 million reduction, for the University of Illinois.

After due consideration, the President of the University decided that all constituents --faculty, administrators and students-- must share in the pain of the budget cuts. Although the University had no salary or price increases at the beginning of the fiscal year, a planned salary increase for January was delayed and an emergency mid-year tuition increase instituted in order to balance the adjusted budget. In light of the bleak outlook for fiscal 1984 and the possibility of the legislature cutting between five and seven percent from the higher education budget, the President ordered the campuses to develop a Doomsday Planning Budget. Our campus, the University of Illinois at Chicago, was to plan for a decrement in state funding of approximately five percent.

Like Gaul of ancient days, the campus has three major divisions, each with its own chief executive: the Vice Chancellor for Academic Affairs, the Vice Chancellor for Health Sciences and the Vice Chancellor for Administration. These three executives, who had been friendly competitors for incremental funding in the past, now had to confront the distribution of a budget decrement.

The Doomsday Planning Budget represented a critical decision making exercise, the outcome of which could have had serious impact on the affected departments and even on the quality of life on the campus. Furthermore, the exercise was to be carried out in a very short time period. In this paper, we will address ourselves to how support was provided to the Vice Chancellor for Administration for this exercise.

In reviewing the problem facing the Vice Chancellor for Administration three major objectives emerged:

- To prepare a Doomsday Planning Budget request which, when reviewed by the Chancellor in competition with budget requests from the two other Vice Chancellors, would show clearly and strongly the negative impact on faculty and students of dramatic budget cuts in support services.
- To examine the manner in which resources were allocated among his units and find ways to absorb budget cuts without endangering the integrity of the entire support service operation.
- To analyze and respond quickly to various allocation strategies suggested in discussions with the Chancellor. and other Vice Chancellors.

The Vice Chancellor had a budgeting process in place. For a number of years, the administrative services units engaged in a modified approach to zero-base budgeting. The process included an annual review of unit functions

in which priorities and costs were examined. An Operations Management Board (OMB), composed of unit directors, faculty and student representatives, conducted open meetings to review and prioritize requests for additional funding and new programs. The Vice Chancellor, in conjunction with his executive staff, reviewed the OMB recommendations and made final decisions on budget allocations.

The budgeting process included for several years a mix of collegial and political decision making. On the one hand, there were open meetings, discussions, compromises and a final consensus on a recommended list of priorities regarding the operating budget. On the other hand, internal political considerations greatly influenced the ultimate decisions. New programs were often funded according to collegial decisions, but for the most part, budgeting was based on a philosophy of incrementalism - a uniform percentage increase applied to all base budgets.

Although the Vice Chancellor planned to continue to receive consultation from the directors reporting to him, he decided to explore and adopt a more systematic, rationally based approach to decision making. Toward this end he requested that the Office of Campus Planning make an indepth analytic examination of the budgets of units reporting to him.

The Vice Chancellor's staff office, the Office of Campus Planning, is charged with responsibility for analytic studies supporting planning and resource management for administrative services units. Members of the Campus Planning staff, including the authors, are experienced at developing small, specialized, information systems to support high level decision making. The Office geared up for a familiar set of project goals. We had to acquire data. We had to tap the vast morass of budgeting, accounting and payroll data available in operation level systems, management information systems, and old budget books. We had to transform the data into information through synthesis and analysis. Then, we had to ensure that the information was useful to the decision maker. The information had to be not only accurate and timely in its delivery, but relevant, and succinct - no information overload, clear, understandable, and responsive to the informational need of the decision maker. But most important and most difficult of all, we wanted to ensure that the information was used - that it was integrated into the complex decision making process. This involved concerning ourselves with communication techniques and organization development techniques necessary to gain acceptance for the study.

It was, in a large measure, this last concern that led us to utilize the microcomputer as the basic tool for this study. The principal decision maker in this situation was the Vice Chancellor for Administration, a results oriented executive, who stays at the cutting edge of management theory and high technology. At the time of the budget crisis, the Vice Chancellor had recently installed an IBM personal computer in his own office and was personally using software products for word processing and time management. In our opinion, he had a high degree of readiness for a trial run at desk-top computing. He was a good candidate for microcomputer based systems on which he could retrieve files to answer ad hoc, unprogrammed questions and operate simple models in which he could vary parameters and examine outcomes. We believed that giving the Vice Chancellor hands on experience in manipulating the information would augment both his understanding of that information and

his sense of ownership and thus increase the likelihood of his incorporating the information into the decision making process.

Our plan was to use the microcomputer, spread sheet software and graphics to develop appropriate and persuasive presentations of current and historical fiscal information. Also, we planned to ease the burden involved in varying budget parameters and preparing alternative budgets. An added advantage was that our approach would save us time on two counts. We could develop the system faster on the microcomputer, and because the decision maker felt comfortable using the new equipment, we could reduce retrieval and analysis time by reducing the need for a middle man.

THE BUDGET STUDY

Our system was developed using an adaptive approach to design. We started with a broad identification of the data necessary to meet the informational requirements for budget planning. We opted to limit programming efforts, relying solely on software in place. We then capitalized on our close working relationship with the Vice Chancellor to establish a feedback mechanism allowing him to frequently review and comment on the type of information, the level of access, and the analysis which would be most valuable in his style of decision making. Finally, it was essential that the system be kept flexible since it had to adapt to changing needs in a volatile environment.

In the end, the system structure looks remarkably like the Executive Information Systems described by Rockart and others.[2] The system development process is dynamic. The information system -- depicted in Figure 1 -- has been through two subsequent revisions since the period covered by this paper.

It is difficult to discuss development of our system in neatly defined segments. The three major components -- data, software, analysis -- are interdependent, and build upon one another. However, in attempting to impose some order on the discussion which follows, construction of the database and development of the budget model have been classified as separate topics.

Construction of the Database

Our goal was to create a data cube - an application database that would synthesize the salient internal data for each organizational unit over time and include key variables reflecting the impact of exogenous factors. In constructing a database for use in analyzing the administrative services budget at UIC, we were attempting to create something not available from any single University data resource. The existing databases and MIS are excellent for department level information or for campus-wide aggregations in one area of application, but none could provide the level or diversity of information needed. Figure 2 illustrates the three major stages of the process: identification and extraction of source data, construction of a comprehensive

[2]John F. Rockart and Michael E. Treacy, "The CEO goes on-line," Harvard Business Review, Volume 60, Number 1, January-February 1982, pp. 82-88.

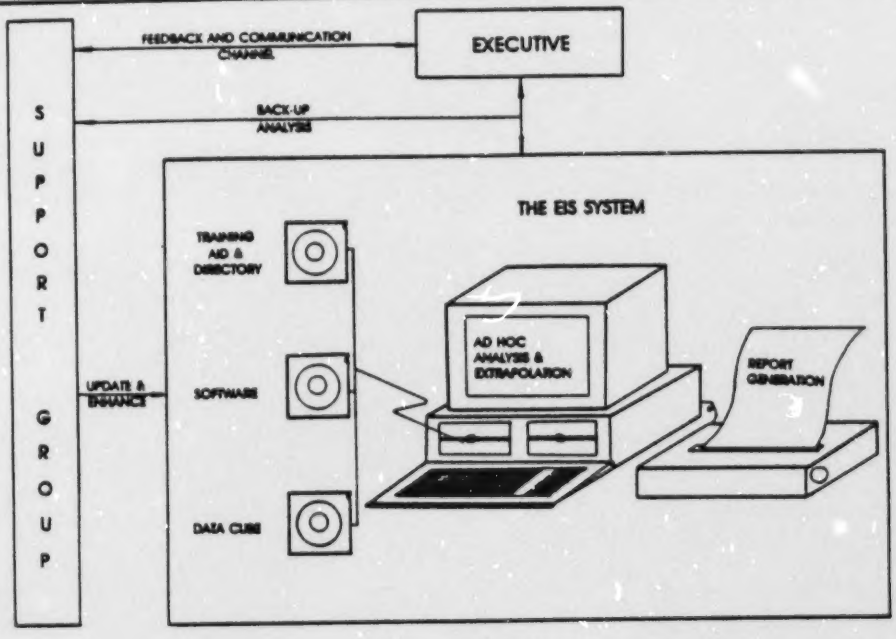

FIGURE 1
OVERVIEW OF THE EXECUTIVE INFORMATION SYSTEM

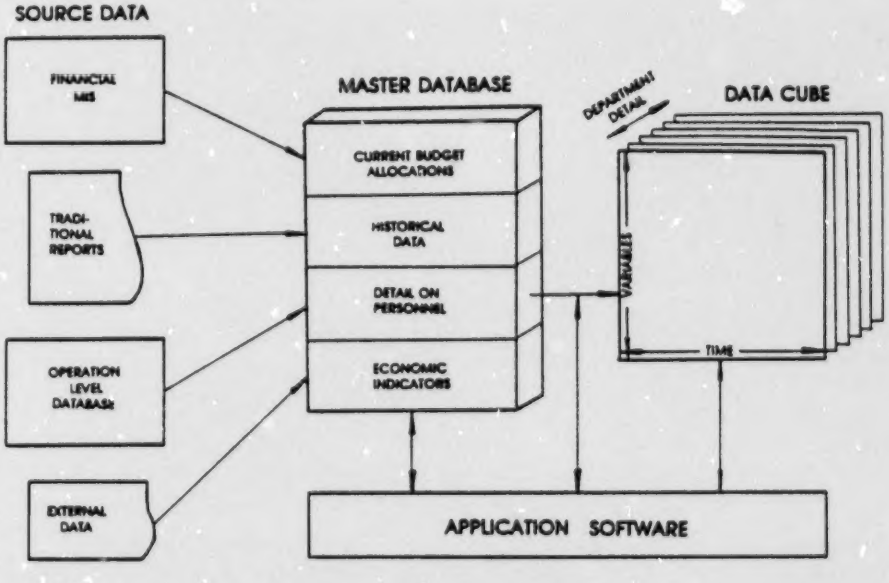

FIGURE 2
CONSTRUCTION OF THE EIS DATABASE

master database with information at the lowest possible level of detail and finally, creation of the executive data cube. Neither master database nor data cube remain static; both are updated on a continuing basis.

There were several dimensions which the database must cover: 1. current information concerning budget allocations, 2. the history of those allocations, 3. details concerning administrative services personnel and, 4. some measure of the external factors which influence the allocations and expenditures. Four sources were identified to provide such information.

For the current fiscal year, highly detailed information could be extracted from the financial information system the university had purchased several years ago. This system provides reports of the account, department, campus and university levels, but it does not have the capability to show more than one level at a time. In order to construct a picture of the administrative services budget we had to identify all accounts within the executive's span of control and to identify the lowest level of expense detail to include. Account detail and the disaggregated expense categories provide two dimensions in the database. Thus, the structure is flexible, allowing for future changes in data categories, for example, changes in organization structure or changes in definitions of major expense categories.

Historical information was not available in any computer file. For this information we identified the annual report submitted to the legislature and the Board of Higher Education. This document is representative of the traditional approach to budgeting and is produced from special reports and from information in the MIS discussed above. The information is reported by function, e.g. instruction, research, public service, student services, institutional support, etc. Expense information is only provided for the broad categories of personal services and expense and equipment (E&E). No further detail is provided. For most departments, however, the information for the last five years is accurate and is adequate for examination of trends and any needed extrapolation. The information system is expandable; as it matures, a greater level of detail will be incorporated. For example, we now have detailed data for FY83 and FY84.

The third component of the database is information concerning the people who work in the administrative service departments. The source of this information is an archaic transactional data processing system used for the university payroll and represents the only source for detailed information concerning university employees. We gain access to payroll data by submitting a request to the data processing department for an extract file from the master. The payroll system is not without it's individual quirks and problems. The extract file requires several stages of adjustment programs before accurate statistics can be generated. Information collected from this source includes variables such as employee classification, FTE, data of first hire, and salary information.

The fourth and last area is external data. In order to take into consideration the effect of exogenous factors which effect budget allocations and expenditures, inflation indices were constructed from monthly consumer prices reported by the Council of Economic Advisors. Algorithms built into

the system allow adjustment for a calendar or fiscal year deflator and can convert the base year to the standard 1967 and 1972, to any year after 1977.

Data collected in the four areas discussed above were entered into four large VisiCalc files.[3] Once the master files were in place, extracts were made to produce the files that would become part of the executive's data cube. The essential information was condensed into a very limited and select set of key variables. Every effort was made to make all the extract files easy to access and manipulate. Everything is clearly identified with labels, built-in formulas provide totals for vertical and horizontal aggregations such as department total and expense category totals, and explanations are provided in the form of footnotes.

Development of the Budget Model

The content of the data cube is determined by the executive's needs for budget information. Similarly, the capabilities and aids built into the model were based on how we perceived the executive would use the system. In designing the system we considered the nature of the data, the available software, method of use and style of the executive, and training tools. In short, we had to individually tailor the system to meet the specific needs, style and temperament of the Vice Chancellor. The resulting system is composed of several parts: the budget files, training and directory tools, generated reports and analytics, and ad hoc analysis.

Initially, the Vice Chancellor planned to rely on the ability to view and print files only, in the traditional "read only" fashion. The many file variations were aimed at satisfying this requirement. As his sophistication increased, and the executive became more comfortable with VisiCalc, the ability to do his own analysis became more important. Eleven files were provided in all. First level files contained department totals for personal services and E&E and showed the bottom line totals for all units reporting to the executive. Subsequent derivations show the distribution of his budget across and within departments for different levels of aggregations. Other files show historical allocation patterns both in current and real dollars and can extrapolate trends based on estimates for future allocations under different scenarios. Finally, a file showing the personnel services and equipment and expense budget for each unit was used as the basic data in constructing a "what-if" module.

The what-if files, can be used to assign a percentage increment or decrement to any category or set of categories. The changes cause an entire new budget sheet to be generated including the aggregated dollar and percentage amount of all the changes. Using these modules, alternative budget options can be easily examined, facilitating the decision making process. The module gave the Vice Chancellor an opportunity to test the effects of both uniform budget changes in which each unit budget is altered by the same percentage, or variable budget changes in which different units are altered by different percentages. It also provided an opportunity to

[3]VisiCalc -- an easy to use electronic spreadsheet package -- is a registered trademark of Personal Software, Inc.

examine how reallocations can be made within the limits of a prespecified fixed total budget.

A simple VisiCalc tutorial and directory of system files was developed to assist the executive in using the system. The information is contained on a diskette that can be used alone or in conjunction with the component files. The tutorial steps through the basics of VisiCalc including how to load and save files, how to manipulate information contained in files, and how to print files using different available options. The directory, provides a succinct description of the contents of each file, describing the calculation of summaries and statistics, and provides the location (cell address) of critical parts of the file.

Although the emphasis in this section is on the technical aspects of the microcomputer based EIS, there are many parts of the system that remain in a more traditional mode. One such component is the production of paper reports. The project summary report serves to show a static picture of the budget at that point in time, provides a document for satisfying other reporting requirements of the university, gives more detailed documentation of the system, and illustrates some of the system's capabilities for analysis. However, one of the real values of the report is that it provides a reference guide for the executive and a transition from reliance on static, traditional reporting to the dynamic qualities of the EIS system. In short, it serves not to answer questions, but to indicate other questions which can be answered with the EIS and a few key strokes.

Graphics are a very important component of the system. Not only do they serve the obvious function of visually illustrating study results, but graphic presentations form an important component of the communication channel for decision support activities. A picture can show the executive at one glance if the analysis is "on the right track." Graphics command attention, they can illustrate various aspects of the budget picture internally or in relation to other parts of the organization or external environment, showing the current picture, what it looked like in the past and, what various alternate scenarios will make it look like in the future. For example, pie charts were used to illustrate the distribution of administrative services funds, trend graphs show the historical allocation of funds and the effect of inflation over time.

Personnel services is the largest component of the administrative services budget; over 80% of the funds not dedicated to utility bills are earmarked for salaries and wages. Because of the magnitude of this budget component, detail concerning the people who work in administrative departments forms an important part of the information system. This information is presently accessible only through the mainframe computer and a system of programs residing in a documented partitioned dataset (PDS). Statistics such as average salaries, headcount, retirement patterns, etc. can be generated by using members of the PDS. Graphics illustrating salary distribution are also produced.

The ability to perform ad hoc analysis is one of the major benefits of an EIS. The clear division of data and programs characteristic of mainframe computing does not exist; the system is not some mysterious black box which performs magic with the data. Rather, the executive can clearly see and understand the system structure. This understanding facilitates the transition to hands-on analysis. By accessing the information directly the Vice Chancellor found that he discovered new insights into his organization and could better define areas in which he needed additional information.

Although interaction of the executive and the information system is of primary importance, the role of the support group remains a critical part of the overall system. In our case, we serve not only as system developers (an on-going process), but also as staff support and the analytical arm of the Vice Chancellor's organization. In the final stages of the Doomsday Planning Budget we assumed responsibility for producing the final interface between the budget model and the doomsday report.

Conclusion of the Study

While the budget study was in progress, the Vice Chancellor for Administration engaged in negotiations with the Chancellor and the other two Vice Chancellors concerning how large a share of the decrement would be borne by Administrative Services. The computer displays, what-if module and hard copy tables and graphs were all used to support arguments and to clarify the need for funds. For the Vice Chancellor for Administration, a key gain was his ability to discredit the myth of huge gains in administrative services funding during the past several years. The data clearly show no real dollar gains in such funding. After long negotiations, a first order approximation to the Administrative Services decrement was set at roughly 5% of the controllable state allocation.

When the time came to determine exactly how the decrement would translate into cuts in service and reductions in staff, the Executive Information System became a support tool in a political process. The what-if module was used to compute the 5% across the board decrement for all support services units and to generate a budget report showing the decrement in each unit. A meeting of the unit directors was convened. Each director was asked to submit a budget statement showing how he or she would absorb the decrement to his or her unit, specifying what functions or service would be eliminated and what staff cuts would result. The key components of statements submitted by the directors were concatenated to the unit record in the microcomputer budget master file. A final summary report was produced showing the proposed changes in services and staff and the fiscal consequences. This report and a brief supporting narrative, written by Campus Planning, went forward as the major documents in the Vice Chancellor's response to the request for a Doomsday Planning Budget. The microcomputer based budget system had contributed substantially to the budget planning process.

SUMMARY

The successful integration of microcomputer support into the Doomsday Planning Budget exercise depended on more than hardware and software. It also depended on giving consideration to processes in place, to the people who have input into, and are affected by decisions, and most importantly to the individual decision making style and temperment of the executive. Further, our success was facilitated by providing learning tools for the executive and by paying close attention to communication techniques, including graphic presentations. These strategies helped the executive understand the information more rapidly and thoroughly, and assisted him in presenting persuasive arguments to his fellow decision makers.

The Office of Campus Planning occupies a position in the organization which was once unusual, but is now becoming quite common - we bridge the gap between data processing and the executive. In conclusion, to others who are assuming similar positions in their organizations we offer ten suggestions for success in their new roles:

1. Keep abreast of the current technological tools.

2. Know what data is available both internally and externally, and have the expertise and "clout" to access it.

3. Have expertise in creating and maintaining data bases.

4. Be skilled as an analyst, synthesizer and model builder.

5. Know the environment and the organization. Have the confidence of the executive and be part of the formal and informal communications network.

6. Be flexible, ready to change and adapt the system design.

7. Have sufficiently good communications skills to present the information in its most useful form.

8. Remember to provide learning tools for the decision makers.

9. Understand learning, problem solving and group behavior well enough to facilitate the integration of the information into the decision making process.

10. Recognize the value and role of information and rational decision making in environments that will always include collegial, bureaucratic and political decisions.